Cordell Bank Ocean Monitoring Program (CBOMP)

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INTRODUCTION

Cordell Bank National Marine Sanctuary (CBNMS) initiated a long-term Monitoring Program in January 2004. Monitoring objectives include:

- Describe the planktonic and vertebrate fauna relative to oceanography
- Assess temporal and spatial variation in occurrence and abundance of fauna and oceanography
- Encourage collaborators to perform integrated ancillary research from the vessel

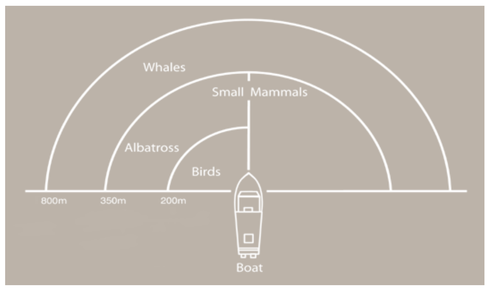


Figure 1. Above Survey zones for whales, birds and small mammals.
Figure 2. Left Research Vessel C. magister at dock Spud Point Marina Bodega Bay Figure 3. Right Observers on Transect during a CBOMP cruise in CBNMS

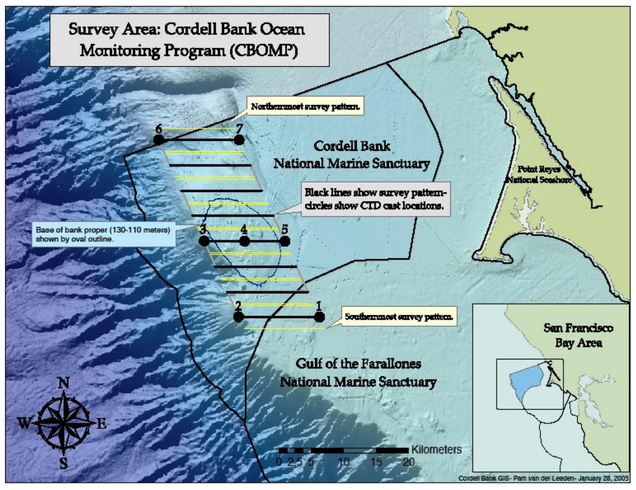


Figure 4. Location of transects and CTD casts (dark circles) within CBNMS.

METHODS – FAUNA

- Surveys are conducted once/month using standard strip transect methodology (weather and ocean conditions permitting). Observers survey quarter-circular areas for birds and semi-circular areas for mammals, forward and abeam of observer location. All birds (except albatrosses), fish, and turtles are counted within 200 m strip; albatrosses are counted within 350 m strip; pinnipeds and small cetaceans are counted within 350 m on both sides of vessel; large cetaceans are counted within 800 m of both sides of the vessel, binned into 200 m strips. Line-transect methodology is also used to survey whales (for comparative purposes). Prior to each survey a float attached to a rod and reel is extended 200 and 350 m to calibrate individual observer distance estimations. Whale distances are estimated with reticular binoculars.

DATE	27-Jan	29-Mar	26-Apr	31-Aug	22-Sep	13-Oct	8-Nov	13-Dec	
Survey lines completed	4	8	8	8	5	8	8	2	
Km surveyed	37	96	96	97	61	105	104	26	
TAXON									
BIRDS									TOTAL
Laysan Albatross	1								1
Black-footed Albatross	2	1	18		1	6	6	7	41
*Northern Fulmar	59	34	221	3		6	419	30	772
*Pink-footed Shearwater	1	1	6	18	22	110	8	1	167
Flesh-footed Shearwater					1		2		3
*Buller's Shearwater				4	24	59	58		145
*Sooty Shearwater		7	35	120		78	56	2	298
Short-tailed Shearwater		1	1				15		17
Manx Shearwater				1					1
Wilson's Storm-Petrel				8					8
Fork-tailed Storm-Petrel				4					4
*Ashy Storm-Petrel			10	1636	4	2			1652
Black Storm-Petrel				20					20
Least Storm-Petrel				5					5
Brown Pelican				1			1		1
Red-necked Phalarope			361	39					400
Red Phalarope			4	7	42	18	7	1	79
South Polar Skua					1	2			3
Pomarine Jaeger				2		3	1	8	14
Parasitic Jaeger			4		1				5
Long-tailed Jaeger				1					1
Bonaparte's Gull		23	20				1		44
Heermann's Gull				1		1			2
*California Gull	24	18	16	5	6	86	39	289	483
Herring Gull	34	5	1				4	12	56
Thayer's Gull	1								1
*Western Gull	1	25	66	53	29	24	74	50	322
Western X Glaucous-winged Gull		5					1		6
Glaucous-winged Gull	1	8					3	15	27
Sabine's Gull				20					20
Black-legged Kittiwake	41	17	1						59
Unidentified Gull	2	2	1						5
Elegant Tern				3					3
Common Tern				3					3
Common Murre		5		4	2				11
Xantus's Murrelet				1					1
Ancient Murrelet		34							34
*Cassin's Auklet	55	1855	919	728	123	2782	603	819	7884
*Rhinoceros Auklet	15	42	42	42	19	14	186	117	477
Tufted Puffin		1			1				2
Bird taxa	13	18	17	25	14	14	18	12	40
Bird total	237	2084	1726	2729	276	3191	1484	1351	13078

Table 1. Survey lines completed, number km surveyed, species, and number of seabirds observed during CBOMP surveys conducted during 2004. Species with asterisk (*) were selected to summarize relative abundance of numerically dominant species; all other species were grouped as 'other'.

DATE	27-Jan	29-Mar	26-Apr	31-Aug	22-Sep	13-Oct	8-Nov	13-Dec	
Survey lines completed	4	8	8	8	5	8	8	2	
Km surveyed	37	96	96	97	61	105	104	26	
TAXON									
MARINE MAMMALS									TOTAL
Northern Fur Seal	2	1	1	2	0	7	3	0	16
Steller Sea Lion	5	0	7	2	0	4	1	0	19
California Sea-Lion	3		1	34		3	8	2	51
Northern Elephant Seal			2	1		2	4		9
Unidentified Pinniped				1	2	1			4
Minke Whale						1			1
Blue Whale				2	7	2	26		37
Humpback Whale				31	8	1	104		144
Unidentified Whale					1				1
Pacific White-sided Dolphin	14			215		1	20		250
Northern Right-whale Dolphin				1		3			4
Risso's Dolphin				14					14
Dall's Porpoise	4		1	26	32		7		70
Unidentified Cetacean			6		1				7
Mammal taxa	5	1	6	11	5	10	8	1	14
Mammal total	28	1	18	329	51	25	173	2	627
FISH									
Blue Shark			1	137	1	4			143
Tuna sp. (prob. Albacore)				2					2
Mola Mola			1	14		1			16
Fish taxa			3	3	2	2			3
Fish total			8	153	2	5			168
TOTAL TAXA	18	19	26	39	21	26			57
GRAND TOTAL VERTEBRATES	265	2085	1752	3211	329	3221	1657	1353	13873
OTHER									
Boat			4	2	1	1			8
Balloon			3						3

Table 2. Survey lines completed, number km surveyed, species, and number of marine mammals and fishes observed during CBOMP surveys conducted during 2004.

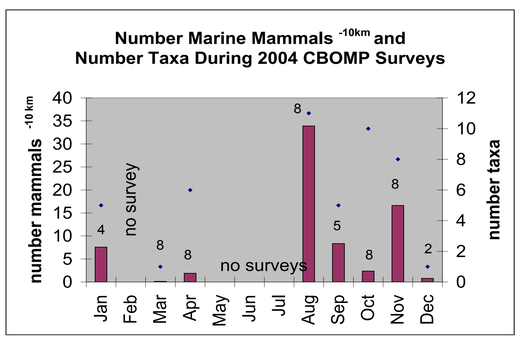


Figure 8. Number of marine mammals per 10 kilometers surveyed (bars) and number of taxa observed (points) during surveys conducted during 2004. Numbers over bars indicate number of transect lines completed during each survey.

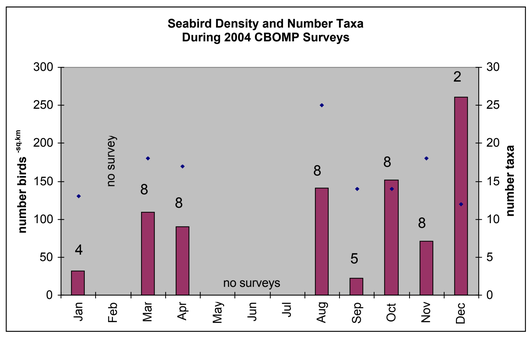


Figure 9. Seabird density (number of birds -sq. km; all species pooled and uncorrected for flight direction) and number of taxa observed (points) during Cordell Bank Ocean Monitoring Program (CBOMP) surveys conducted in 2004. Numbers over bars indicate number of transect lines completed during each survey.

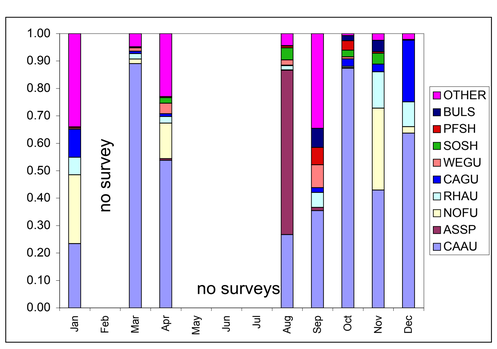


Figure 10. Relative proportion of Cassin's Auklet (CAAU), Ashy Storm-Petrel (ASSP), Northern Fulmar (NOFU), Rhinocerous Auklet (RHAU), California Gull (CAGU), Western Gull (WEGU), Sooty Shearwater (SOSH), Pink-footed Shearwater (PFSH), and Buller's Shearwater (BULS) during (CBOMP) surveys conducted in 2004.

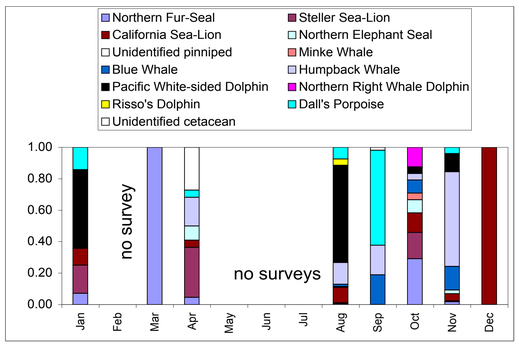
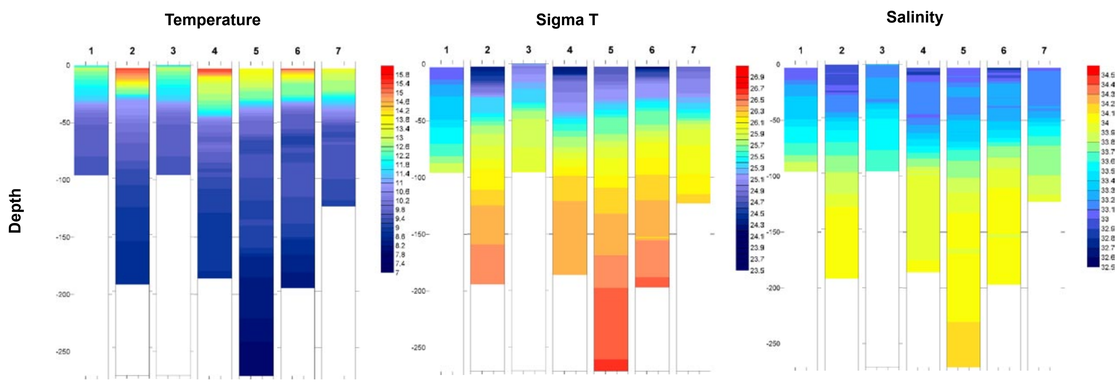


Figure 11. Relative proportion of Northern Fur Seal, Steller Sea Lion, California Sea Lion, Northern Elephant Seal, Unidentified Pinniped, Minke Whale, Blue Whale, Humpback Whale, Pacific White-Sided Dolphin, Northern Right Whale Dolphin, Risso's Dolphin, Dall's Porpoise, and unidentified cetaceans observed during CBOMP surveys conducted during 2004.

METHODS – OCEANOGRAPHY

- Thermosalinograph used to record sea surface temperature (SST) and sea surface salinity continuously along transect lines.
- CTD casts performed at selected locations using a SEABIRD SBE 19; data processed using SBE software and displayed using Surfer 7.0 .
- Simrad EK60 echosounder with single 120Khz split-beam transducer used to estimate krill abundance.
- ArcView 9.0 Geographical Information System (GIS) used to integrate backscatter, fauna, and oceanography. SSTs were interpolated from TSG data using kriging.



Figures 5-7. CTD casts for October 13, 2004. Each colored bar represents an individual CTD cast of the 7 CTD cast locations shown in Figure 4. Depth of each cast is shown on the Y axis.

PRELIMINARY RESULTS - 2004

- Eight surveys were conducted (due to weather and mechanical problems no surveys were conducted in Feb, May, June, July).
- 10,243 birds of 40 taxa, 501 marine mammals of 13 taxa, and 168 fish of 3 taxa were censused.
- Depth, sea surface temperature, and backscatter mapped, and sighting locations of fauna for the October 2004 survey overlaid. High backscatter was documented along the shelf-break and this likely reflected krill abundance (based on similar work being conducted during the Wind to Whales surveys in Monterey Bay).
- CTD casts showed stratified and unstratified profiles depending on wind conditions. A cold water cell was embedded in the warmer stratified water between 50 - 100M and was apparent in profiles 4-6 in the late fall and into winter.

SEABIRDS

- Cassin's Auklet were the most abundant seabird observed during all surveys; Densities varied spatially and temporally, likely reflecting variation in krill densities.
- Ashy Storm Petrel was the most abundant species during the August survey, when >6000 were estimated on and off transect.
- Unusual species sighted included the Laysan Albatross, Manx Shearwater, Black and Least storm petrels, and Xantus' Murrelet.

MARINE MAMMALS

- Humpback and Blue Whales were relatively abundant in September and November.
- Dall's Porpoise were relatively abundant in September.
- Pacific white-sided dolphins were relatively abundant in January and August.
- Greatest diversity of marine birds and mammals occurred in August.

FUTURE PLANS and ANALYSIS

- Add a Wetlabs flourometer comparable to the flourometer on the CTD which will sample continuous surface chlorophyll.
- Ground-truth backscatter data to classify as krill or other plankton.
- Conduct spatial analysis to test for mechanistic relationships between oceanography, prey, and marine birds and mammals.
- Document how relationships may change seasonally and annually in the context of the larger-scale distribution of predators in the Cordell Bank, Gulf of the Farallones and Monterey

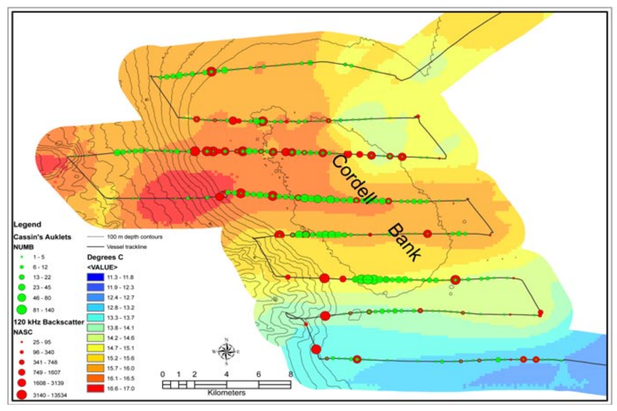


Figure 12 Cassin's Auklets and 120 kHz echosounder backscatter for October 13, 2004. Backscatter along shelf-break is likely krill.

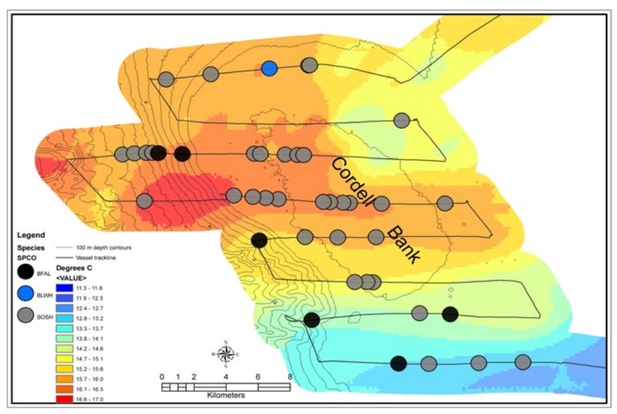


Figure 13. Blue whale (BLWH), Black-Footed Albatross (BFAL) and Sooty Shearwater (SOSH) sightings from the October 13, 2004 cruise. The BLWH was a pair, the SOSH groups ranged from 1-10, and the BFAL were all individuals.

ACKNOWLEDGEMENTS

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